MODEL 218 AC
SERVICE DATA SHEET No. 1

CIRCUIT DESCRIPTION

VALVE LINE-UP

EF80 F.M. R.F. Amplifier, ECC85 F.M. Oscillator and Mixer, ECH81 F.M. Frequency Changer and F.M. I.F. Amplifier, EF85 AM/FM I.F. Amplifier, EABC80 2nd. Detector A.M., Ratio Detector F.M., Audio FM/AM., EL84 Output FM/AM., EZ80 Full Wave Rectifier, EM80 Electronic Tuning Indicator.

GENERAL DESCRIPTION

A four waveband superheterodyne receiver employing 6 valves, plus rectifier and Tuning Indicator. The receiver has been designed for the reception of both Frequency, or Amplitude modulated signals. There are, basically, two units, one being the Main Chassis, the other the F.M. Tuner Unit.

The Tuner Unit contains the F.M. R.F. Amplifier, Oscillator, and Mixer stages. Also on this unit is the four section tuning gang, the two outer sections used for Short, Medium, and Long wavebands, whilst the two smaller inner sections are used to tune the F.M. Band (87—101 Mc/s.).

On the Main Chassis is a 5 position Waveband changing switch selecting : Gram, L.W., M.W., S.W., and F.M. (The F.M. Position being fully clockwise).

A.M. AERIAL CIRCUITRY

The coils L7 and L8 wound on a Ferrite rod form the Long, and Medium Waveband Aerials. Medium Wave coil L8 is tuned by C27., Aerial trimming is by C25. On medium Wave L7 is shorted out, whilst on Long waves L7 and L8 are in series.

The S.W. Aerial connects to the coupling Coil L9, which is inductively coupled to L6 Tuned Aerial Coil trimmed by C24. Signals are fed to the Frequency Changer (V3) grid via condenser C28 on all three bands.

A.M. OSCILLATOR

The Oscillator is of the tuned Grid Type. L11 trimmed by C36 being the S.W. Coil, L13 trimmed by C37, and padded by C40 being the Medium Wave, and L15 trimmed by C42 is the L.W. Grid Coil with C41 as a fixed Padding Condenser. The Oscillator Anode Coils L12 (S.W.), L14 (M.W.) and L16 (L.W.) isolated from H.T. by C35, are feedback coupling coils to maintain oscillations.

I.F. AMPLIFIER

The A.M. and F.M. I.F. Transformers are connected in series. The F.M. 10.7 Mc/s I.F. Transformer is connected directly to the anode of V3 to ensure that stray pick up is avoided by keeping the interconnecting leads as short as possible. A.V.C. is applied to the I.F. Amplifier (V4) grid via R15, C51 decoupling.

During A.M. operation the F.M. I.F. Transformer T.1. is short circuited by switch contacts (shown in diagram as S4a).

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2nd. DETECTOR, AUDIO FREQUENCY and OUTPUT STAGES

The I.F. Amplifier is fed through the F.M. Discriminator Transformer primary and the primary of the 2nd. A.M. I.F. Transformer, which are in series. Decoupling is via R23, C54 then via C53 to the junction of R18, R22 in V4 cathode (C53 and C54 should be replaced by identical types, and lead lengths). The I.F. Output is fed to the A.M. Diode D1 of V.5. The low potential end of the I.F. Secondary is fed to the Gain Control via the Filter Network R27, C57, C62 the waveband Switch S7, and the Filter Network R28 C69. The gain Control forms the A.V.C. Diode Load. The A.V.C. is taken from the junction R27 C62 via Waveband Switch S6 to the grids of Frequency Changer (V3), and the I.F. Amplifier (V4) via R16, C44, R7 and R15, C51 the respective decoupling. Audio voltages are fed to the 1st. Audio valve grid via C64, R34 being the grid leak of this stage. A conventional Audio Output stage (V6) is matched to the low impedance Loud Speaker load by the transformer T.5. Feedback from the Output Transformer (T.5) via R39 to the Gain Control (Junction R32, R33) is utilised in the Tone Control Network, which provides choice of three tones—"Low" "Medium" or "High" selected by Tone Switch S8 and S9.

When on A.M. Reception the 200 V H.T. supply to the F.M. Oscillator and Mixer is switched off by Waveband Switch S4. V3 grid is switched to the A.M. Aerial circuitry by Waveband Switch S2, at the same time F.M. Coil L10 being disconnected.

F.M. SECTION

The signal is applied to the grid of R.F. Amplifier (V1) via coil L1. This coil is tapped to provide a suitable match for the 70/80 ohm coaxial aerial input. An external aerial may be used if desired on F.M. by unplugging the built-in F.M. Aerial and plugging the external aerial into the socket then available.

The signal frequency from V1 is tuned by Coil L3 which is isolated from H.T. by C2. Trimming of L3 is by C4 at 101 Mc/s and by slug tuning at the 87 Mc/s end.

The coil L3 then passes the signal to the Mixer (V2A) grid via C8. The F.M. Oscillator is a modified Colpitt's with temperature compensating capacitors to keep the frequency drift to a minimum regardless of operating temperature changes. The following capacitors are critical, and, if replaced must be of the original type with the original lead lengths : C15, C18, C21, C23, and C6 in the Mixer grid circuit. C14 feeds the Oscillator output to the Mixer Grid. The resultant I.F. of 10.7 Mc/s is present in the anode circuit across L4 and is fed via C13 connected at the low potential end of L4 to the Tuned Input circuit L10, of V3 which now acts as an I.F. Amplifier. Waveband Switch S4. removes the A.M. Oscillator section H.T. and S.3 disconnects the A.M. Oscillator coils. V3 amplifies the modulated I.F. signal and passes it to the 10.7 Mc/s tuned transformer T.1. The signal is mutually coupled to the I.F. Amplifier (V4) and the amplified signal appears on the primary of the Discriminator Transformer (T3) which forms the anode load of V4. The coupling coil to the secondary is by the Tertiary winding and the centre tap of the secondary is provided by C60, 61. The outer ends of the secondary are taken to the F.M. Diodes—one end to the cathode of D2. the other end to anode of D3. Anode of D2 and cathode D3 are taken to the load resistor R30. The phase at one end of the secondary is always 180° different to the other end i.e. when the carrier has no deviation due to audio modulation the currents in the two diodes are equal. When the currents become unbalanced due to modulation of the carrier the audio voltages appears at the junction of C60, C61—R25, R26 together with C56 forming the de-emphasis network. The audio voltage is fed to the audio amplifiers from the junction of R24, C56 via S7.

POWER SUPPLY AND H.T. SMOOTHING

H.T. is supplied by the Transformer T6 (195-225 or 225-255V A.C. input) using the EZ80 as a Full Wave Rectifier C72 is the reservoir condenser and R43, C73 provide smoothing. The junction R43, C73 is the 250V H.T. line which is further smoothed by R42, C74 to provide the 200V H.T. supply. Dial lights are fed from a tapping on the heater winding. The Capacitors C72, C73, C74 are included in a 3 section electrolytic each section 16 mF—Reservoir section marked red—can negative.

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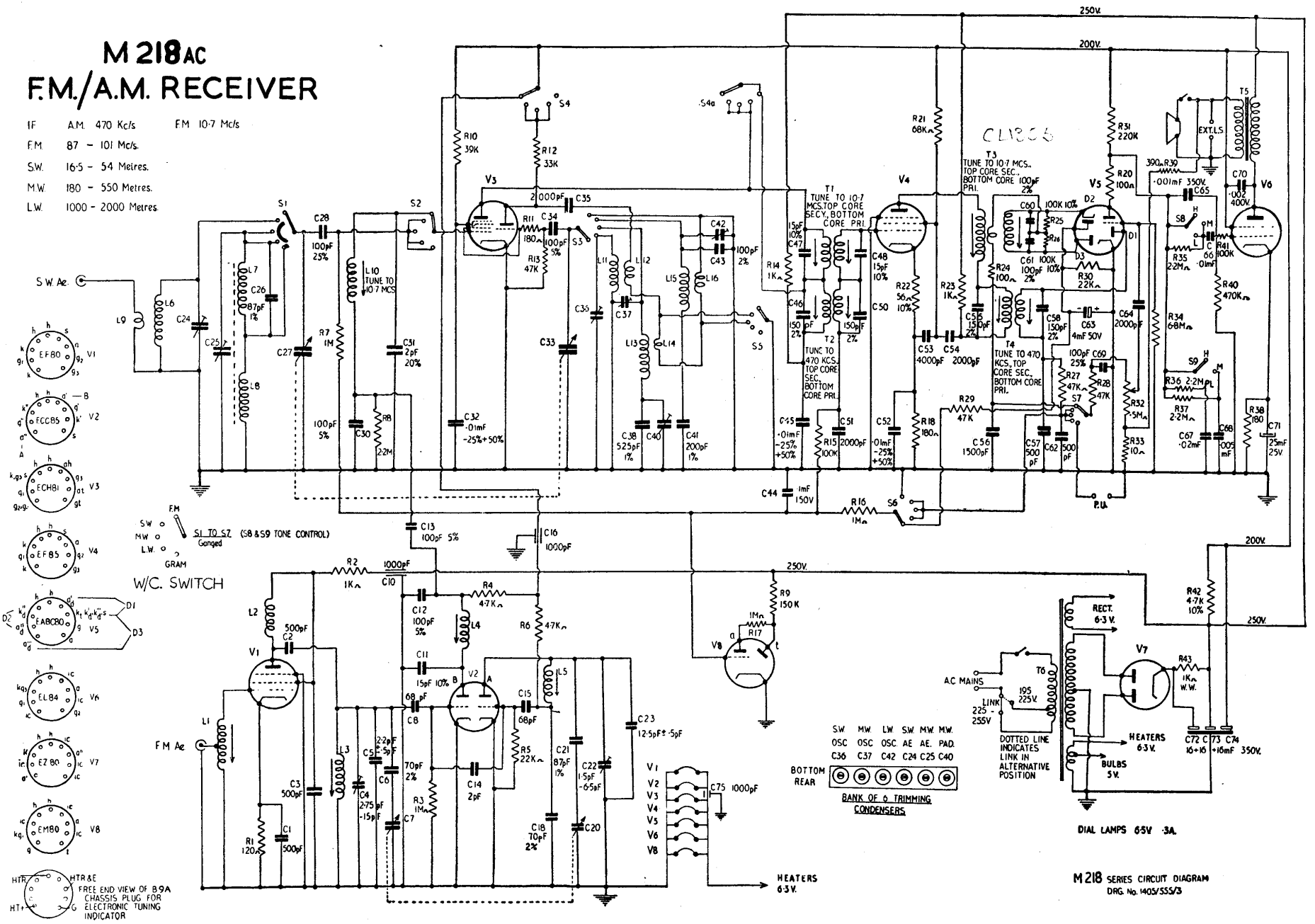
CIRCUIT DIAGRAM



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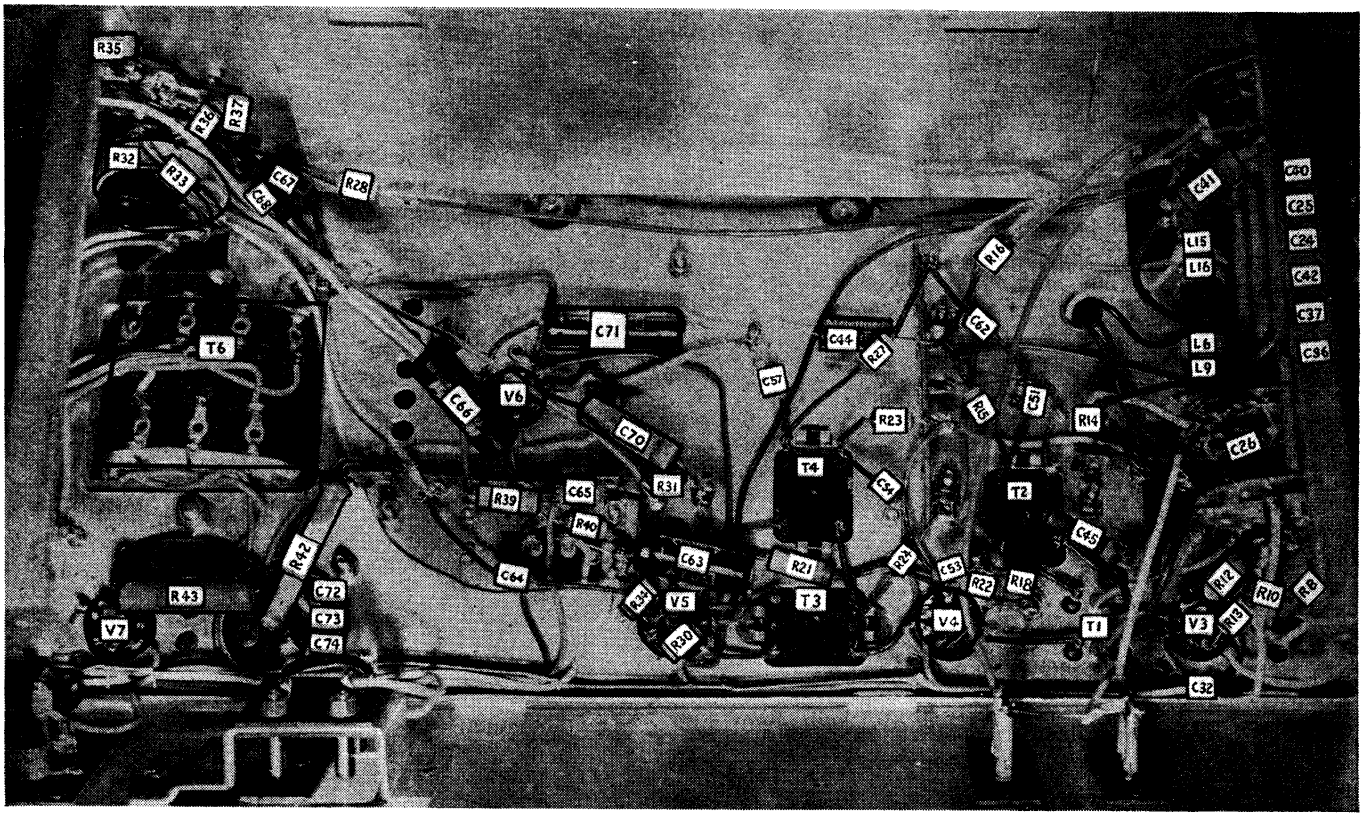
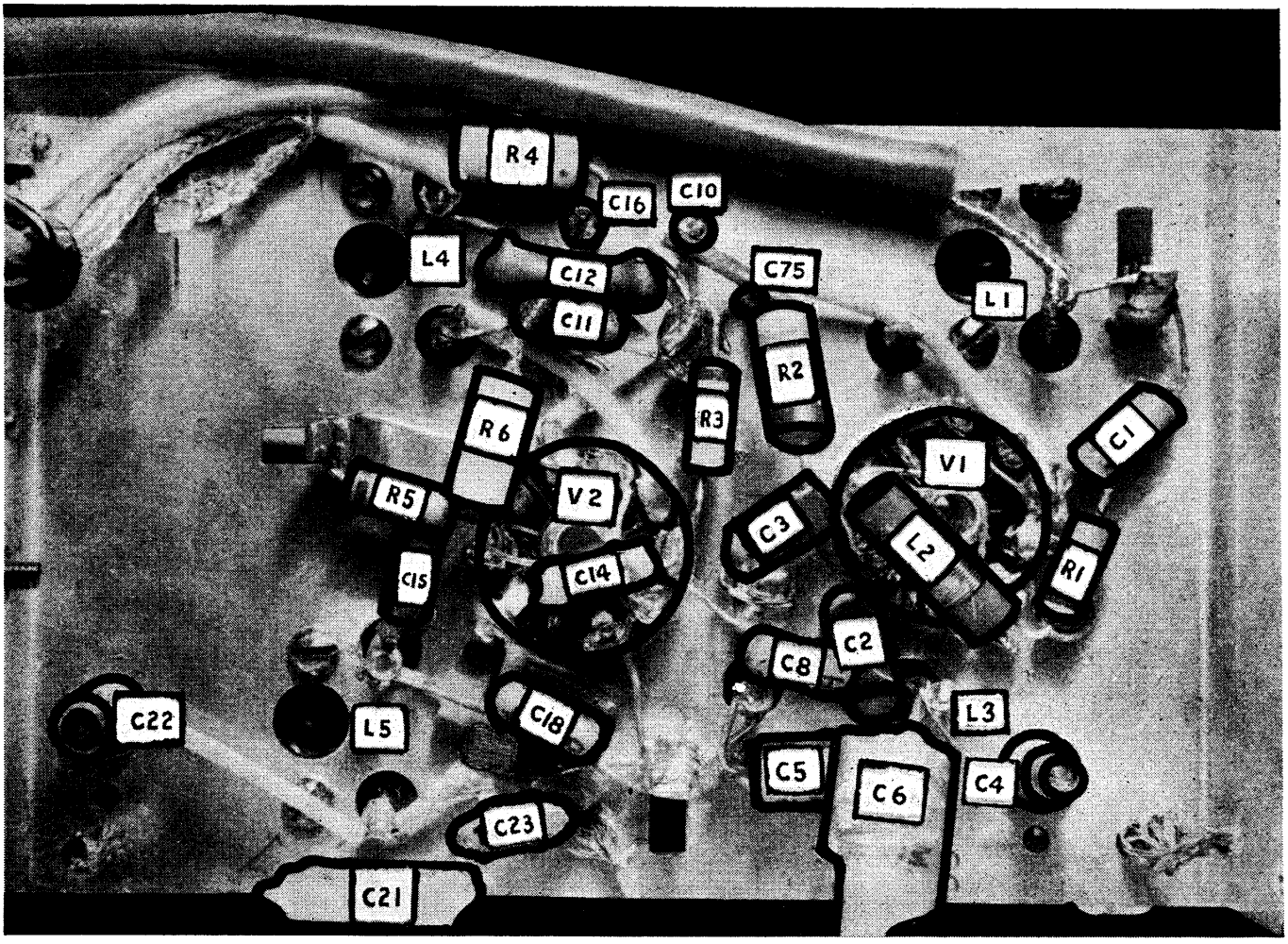
UNDER MAIN CHASSIS



UNDER F.M. TUNER UNIT



CIRCUIT ALIGNMENT

EQUIPMENT REQUIRED

(1) Calibrated signal generator preferably with F.M. and A.M. modulation, but A.M. only will suffice. Must cover from 100 Kc/s to 100 Mc/s.
(2) Insulated trimming screwdriver.
(3) 6 B.A. box spanner or trimming tool.
(4) Coupling loop (see diagram).
(5) A.C. voltmeter connected to loudspeaker terminals (AVO on .1 amp A.C. range is suitable.)
(6) Centre zero 50—0 .50 micro-ammeter or low current rectifier instrument.
(7) Resistor pad consisting of two resistors between 3K and 5K—actual value not critical but must both be *exactly* the same value.
(8) A few short leads, fitted with crocodile clips at each end, for short circuiting the A.V.C. etc.

A.M. I.F. ALIGNMENT

Switch to Medium waveband and with the tuning gang fully meshed connect the signal generator to the ECH81 grid (pin 2). Set the generator to 470 Kc/s amplitude modulated.

Stop the local oscillator working by connecting a short piece of wire across the rear section of the tuning gang.

Set volume control to maximum and trim the I.F. cores in the following order for maximum output using A.C. voltmeter across the loudspeaker terminals.

(1) Top core second I.F. transformer.
(2) Bottom core second I.F. transformer.
(3) Top core first I.F. transformer.
(4) Bottom core first I.F. transformer.

As the circuits come into line reduce the signal generator output to prevent the A.V.C. circuits operating. Do not turn down the volume control.

F.M. I.F. ALIGNMENT

Switch to F.M. waveband and with tuning gang fully meshed connect the signal generator to the ECH81 grid (pin 2). Set the generator to 10.7 Mc/s frequency modulated if this feature is available. The generator output must be connected to the set by *Short leads* at the end of a properly terminated coaxial cable. If this is not done there is a chance of instability.

Short circuit the A.V.C. line by connecting a lead across C44.

With short connections join the two resistors, mentioned in "Equipment Required", in series across R30 and connect the centre zero meter or low current rectifier instrument from the junction of the resistors to chassis.

Screw all cores of T1, T3, L4 and L10 level with end of former. Screw in T1 primary (bottom core) until it is about $\frac{1}{8}$" into the former and trim as follows :—

(1) Primary of T3 (bottom core, for maximum reading.
(2) Primary of T1 (bottom core) for maximum reading.
(3) Secondary of T1 (top core) for maximum reading.

Transfer the signal generator to the ECC 85 grid (pin 7) and trim :—

(4) L10 for maximum reading.
(5) L4 for maximum reading.
(6) T1 primary (bottom core) for maximum reading.
(7) T3 primary (bottom core) for maximum reading.

Transfer the signal back to the ECH81 grid (pin 2).

Disconnect the lead—which is jointed to chassis—of the centre zero meter and join it instead to the junction of R24 and C56. The other lead is left joined to the junction of the two resistors as before.

Increase the output of the signal generator and trim T3 secondary.

If a centre zero meter is used there will be two peaks giving pointer movement in opposite directions.

The core should be set to read zero on the meter midway between the two peaks.

If a rectifier instrument is used there will be two peaks and a zero point between. The core should be set to the zero on the meter midway between the peaks but care should be taken as this is the least sensitive setting for this type of meter.

Remove the short circuits on gang and A.V.C. line. Disconnect meter.

When frequency modulation is available it should be checked that when a signal is tuned in for maximum deflection on the tuning eye this corresponds with minimum distortion. This can be done by ear, but is best checked with an oscilloscope if available.

A.M. SIGNAL ALIGNMENT

Short Waves

Set pointer to the dots at the extreme right hand end of the tuning scale with the tuning gang fully meshed.

Connect the signal generator to the aerial terminals by means of an artificial aerial.

Set the generator to 17 metres (17.65 Mc/s) and amplitude modulation.

Tune the receiver until the pointer is on the 17 metre mark on the scale. Adjust C36 and C24 for maximum output.

CIRCUIT ALIGNMENT—continued

Note. Two peaks will be found on C36. The correct one is the first tuning point as the trimmer is screwed from minimum capacity. This should be checked or alignment will be on the wrong channel.

C36 and C24 should be adjusted in turn two or three times to ensure that maximum sensitivity is obtained.

Medium Waves

Connect the coupling loop to the signal generator and set it not less than the ferrite aerial rod length (8 inches) to the left of the receiver.

Set the signal generator to 1500 Kc/s and tune the receiver until the pointer registers 200 metres on the dial. Switch to M.W.

Adjust C37 until the signal is obtained and adjust C25 for maximum response.

Set the generator to 600 Kc/s and tune the receiver until the pointer registers 500 metres. Adjust the medium wave padder C40 for maximum whilst "rocking" the gang.

Repeat both operations until no further improvement can be obtained.

Long Waves

Still using the coupling loop on the signal generator as for medium waves, switch to L.W. and adjust the tuning control until the pointer registers 1000 metres on the dial.

Set the signal generator to 300 Kc/s and adjust the oscillator trimmer C42 for maximum output whilst "rocking" the gang.

Check the 2000 metre point on the dial with the signal generator set to 150 Kc/s.

F.M. SIGNAL ALIGNMENT

Connect the signal generator to the aerial terminals with a short correctly terminated coaxial lead.

Set the signal generatior to 88 Mc/s and frequency modulation. Tune the receiver until the pointer coincides with 88 Mc/s on dial.

Adjust L3 and L5 for maximum output (meter across loudspeaker terminals).

Tune the receiver to 100 Mc/s.

Set generator to 100 Mc/s.

Adjust C22 and C4 for maximum output.

Repeat the above operations until no improvement can be obtained.

Set generator to 94 Mc/s.

Tune receiver to 94 Mc/s.

Adjust L1 for maximum output.

If the generator is not frequency modulated the signal should be tuned in on the oscillator L5 or C22 and left slightly offset. L3 or C4. should then be adjusted for maximum and L5 or C22 finally set for minimum output between the two peaks. Otherwise proceed as above.

VOLTAGE MEASUREMENTS

VALVE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
EZ80	A 278V. AC.	—	K 300V	H 6.3V. AC.*	H 6.3V. A.C.*	—	A 278V. A.C.	—	—
EL84	—	G1 —	K.G3 5.3V A.M. 4.5V F.M.	H E	H 6.3V. A.C.	— —	A 220V.	— —	G2 155V. F.M. 176V. A.M.
EF85	K 1.55V F.M. 1.7V A.M.	G —	K 1.55V F.M. 1.7V A.M.	H E	H 6.3V. A.C.	S —	A 270V.	G2 70V. F.M. 86V. A.M.	G3 —
ECH81	G2. G4. 50V. F.M. 56V. A.M.	G1 —	K.G5. S —	H E	H 6.3V. A.C.	Ah 200V. F.M. 225 A.M.	G3 —	AT F.M. 55V. A.M.	GT — —
EABC80	AD3 —	AD2 —	K. D2 —	H E	H 6.3V. A.C.	AD —	KT., KD1. KD2.	G1 —	A 52V
ECC85	A2 100V	G2 —	K2 —	H 6.3V. A.C.	H E	A1 125V.	G1 —	K1 —	S —
EF80	K 2.15V	G1 —	K 2.15V	H 6.3V. A.C.	H E	S —	A 205V.	G2 205V.	G3 —
EM80	G1 —	E1 —	—	H E	H 6.3V. A.C.	—	A‡ 16V.	—	T 150V.

Mains input voltage 230V AC. 50 cycles on the 225—255V tap

All voltage maesured on the AVC model 7 meter.

All cathode voltages mesaured on the 10V A.C. Range, other voltages measured on the 400V. D.C. Range, measurement made between pin indicated and chassis.

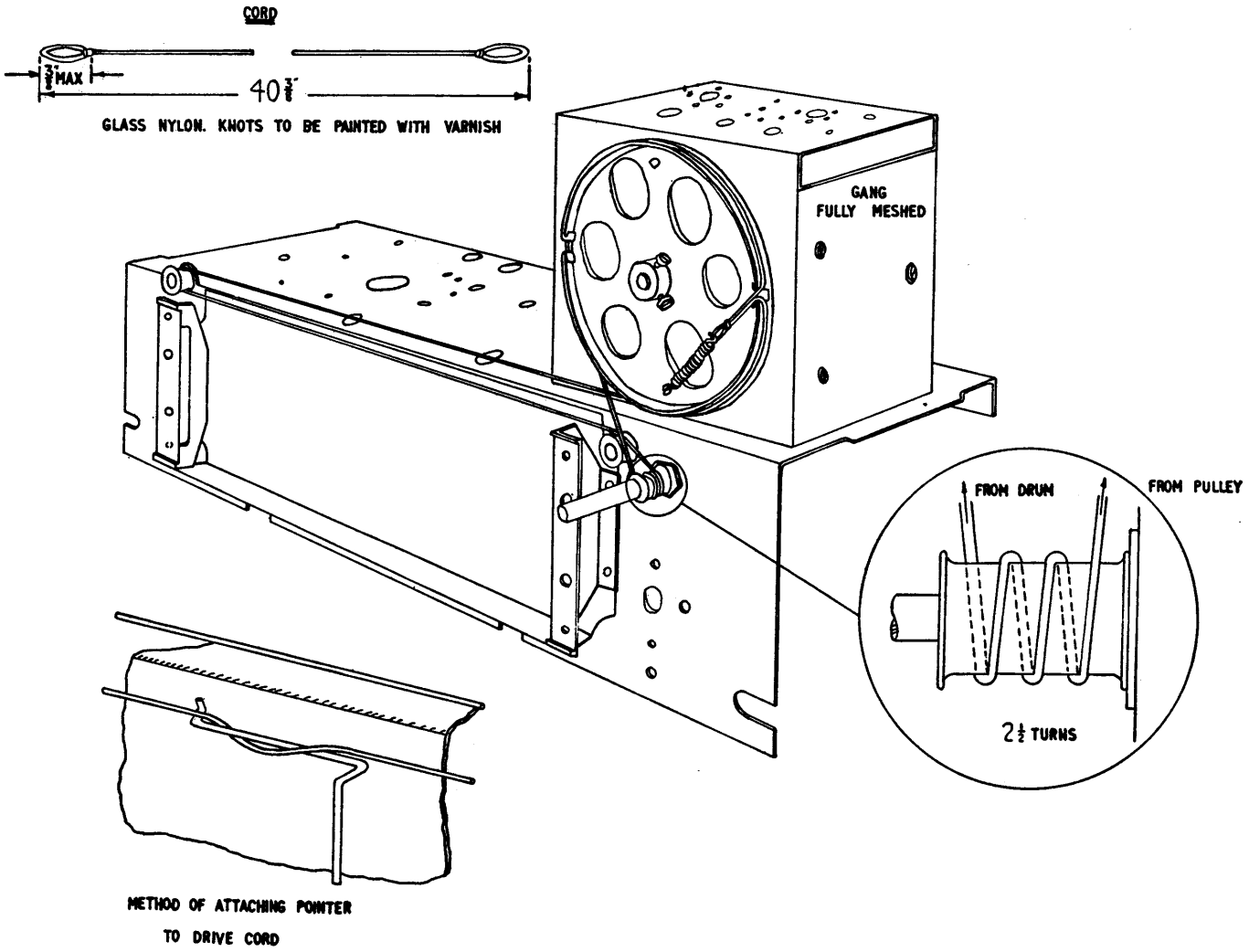
Heater voltages measured on the 10V A.C. Range.

Rectifier anodes measured on the 400V A.C. Range.

* Measured between pins 4—5.

‡ This reading is low, due to the loading effect of the meter.

DRIVE CORD FITTING AND POINTER FITTING DIAGRAM



COIL INDUCTANCE & RESISTANCE VALVES

	L uh	R ohms		L uh	R ohms
L1 Ae. input coil F.M.	0.229	Low	L8 M.W. Ae. coil	150	0.82
L2 Anode choke F.M.	9.41	Low	L9 S.W. Ae. coupling coil	0.6	Low
L3 Intervalve coil F.M.	0.086	Low	L10 ECH81 Grid coil F.M.	9.8	Low
L4 Output coil F.M.	7.35	Low	L11 S.W. Osc. coil	1.10	Low
L5 Osc. coil F.M.	0.097	Low	L12 Osc. coupling coil	0.55	Low
L6 S.W. Ae. coil	1.32	Low	L13 M.W. Osc. coil	85	5.
L7 L.W. Ae. coil			L14 Osc. coupling coil	58	3.8
(L.W.+M.W. windings)	1970	4.	L15 L.W. Osc. coil	416	11.
			L16 Osc. coupling coil	127	5.7